

TANGIER ISLAND, VIRGINIA

PRELIMINARY

ANALYSIS OF BATHYMETRY

AND

SEDIMENTS

FEBRAURY 1983

BY

WATERWAY SURVEYS & ENGINEERING, LTD.

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**MEMORANDUM**

**TO:** Woody Holton  
**FROM:** Cy Galvin  
**SUBJECT:** Analysis of Survey Data

**Sediments.** Figure 1 gives the location of the 35 sampling sites taken by WS&E during the October 1982 survey along the western shore of Tangier Island. Sampling sites are marked either as a beach sample (closed circle) or an offshore sample (closed triangle). Samples 1 thru 3 were taken north of the disposal area, samples 4 thru 11 within the disposal area, samples 12 thru 17 in the marsh area south of the disposal, and samples 18 thru 35 along the spit. Table 1 provides a cross-reference of the sample identification numbers used by this office and WS&E.

Figure 2 summarizes the results of the sieve analysis of these samples giving the  $d_{50}$  size at each site. For comparison, beach samples taken by WS&E during a previous survey in 1981 are represented by the solid squares. Figure 2 shows that the beach samples consist of fine to medium sand with  $d_{50}$  sizes ranging from 0.15 mm to 1.4 mm. The finest beach materials are located within the disposal area (sites 4 thru 11) and the coarsest beach materials along the spit. The beach materials at 3 of the 8 sampling sites within the disposal area are similar to the sediment dredged from East Channel. Pipeline samples taken by the Corps indicate  $d_{50}$  sizes ranging from silts and clays to fine sands ( $d_{50} \leq 0.25$ ). These sizes are similar to the sizes of materials found at sites 5, 7, 9 along the former shoreline in the disposal area.

Materials sampled at the remaining sites in the disposal area (4, 6, 8, 10, 11) are somewhat larger, ranging from 0.30 mm to 0.53 mm. These five sites lie along the seaward edge of the disposal mound and have been influenced by wave action and tides transporting the finer materials away from the area.

The beach samples taken along the spit consist entirely of medium size sand with the coarsest material ( $d_{50} = 1.4$  mm) located at site 19, which is the north end of the spit (see Figure 1). From this site, the  $d_{50}$  sand size decreases to the south. Note that samples taken in 1981 by WS&E do not decrease southward along the spit. However, the 1981 samples are similar in that they are medium sands and one of the 1981 samples (Sample T-3) has a size close to the adjacent 1982 samples (Site 26).

The offshore samples are south of the disposal area, and consist of materials ranging from silts and clays ( $d_{50} < 0.074$  mm) to medium sands ( $d_{50} = 0.76$  mm). There are no offshore samples located offshore of the disposal area. Unlike the beach materials, the  $d_{50}$  size of the offshore samples increases from north to south along the spit. The silt and clay at site 20 is along the same profile line (SR-8) as the coarse beach material at site 19. These two samples on the same profile line have the coarsest and finest sizes in the 35 samples analyzed.

**Bathymetry.** Contour lines drawn in the vicinity of the disposal area (Figure 3) show a constant sloping bottom to a depth of 6 feet MLW. Below this depth the bottom becomes more irregular with ridges and valleys as shown by the 7, 8 and 9 foot contour lines.

Contour lines drawn along the spit (Figure 4) show a series of linear ridges parallel to the shoreline which indicate a fairly strong current parallel to the shoreline. The bottom slope is steepest at the north end of the spit and steadily flattens out to the south. The position and spacing of the contours between profile lines SR-6 thru SR-8 (where the shoreline turns and heads southeast along the spit) suggests that the maximum current velocities occur at this bend.

**Summary and Conclusions.** The sediment data indicate a wide range of sizes from silts and clays to medium sand. Samples taken along the eastern edge of the disposal area are similar in size to the material pumped from East Channel. On the other hand, samples taken along the seaward edge of the disposal mound indicate that much of the fine material from East Channel has already been transported away.

The decrease in  $d_{50}$  grain size of the beach samples taken southward along the spit indicate sediment transport to the south. Of particular interest are the size of materials taken at sites 19 and 20 near where the shoreline rotates 45 degrees to head southeast along the spit. At these sites, along profile line SR-8, the coarsest material in 35 samples was found on the beach ( $d_{50} = 1.4$  mm) while offshore, the materials sampled were among the finest ( $d_{50} \leq 0.074$  mm).

The bathymetry at the disposal area shows a constant sloping bottom to the 6 foot contour followed by an irregular bottom with ridges and valleys. The bathymetry along the spit suggests strong currents parallel to the shoreline.

In addition, the parallel spacing and position of contour lines suggest the northern portion of the spit is a region of maximum velocity.

From this data, one may conclude that the seaward edge of the disposal area is winnowing from wave action and tides. This is evident from the fact that the fine materials from East Channel ( $d_{50} \leq 0.25$  mm) are not found at the seaward disposal area sampling sites 4, 6, 8, 10, 11 which have  $d_{50}$  sizes ranging from 0.34 mm to 0.53 mm.

In addition, it appears that the sediments from the disposal mound have not reached the spit as of the October 1982 survey. A comparison of sediment samples taken in 1981 and in October 1982 by WS&E indicate that the beach materials have become coarser along the length of the spit between the time of the two surveys. Assuming the fine materials from the disposal mound had been transported to the spit previous to the October 82 survey, one might expect the latest sampling of beach materials along the spit to be finer than those sampled in 1981. However, as shown in Figure 2, the sediments from the disposal area are much smaller than the beach samples taken along the spit in the October 1982 survey. Therefore, the materials from the disposal mound may be transported along the spit without being deposited along the beach.

The location and rate of transport of this sediment will be better understood following the second set of surveys. The northern portion of the spit (between profile lines SR-6 and SR-8) requires further field investigations to explain the wide range of materials deposited in this area and evaluate the transport along the western shore of Tangier Island.

### Action Items.

1. Locate the position of WS&E sampling sites SS-7, SS-35, and SS-36. These three sites are not marked on the survey map.
2. Take soundings along one additional profile line between SR-7 and SR-8 during the next survey. Take additional sediment samples along this new profile line as well as lines SR-6 thru SR-8 as shown in Figure 5 (eight new samples).
3. We would like to make arrangements to visit the site during the next survey to take photographs and study the coastal processes along the northern portion of the spit. Please inform us of tentative dates for the next survey. Based on scheduling of future projects, the period 4 thru 15 April 1983 would be a good time for this office.

JRH 1 February 1983

### 4 Attachments

- Figure 1. Sediment Sampling Sites.
- Figure 2. Sediment Characteristics
- Figure 3. Bathymetry at Disposal Site
- Figure 4. Bathymetry Along Spit
- Figure 5. New Profile Line and Sediment Sampling Sites
- Table 1. Sediment Data

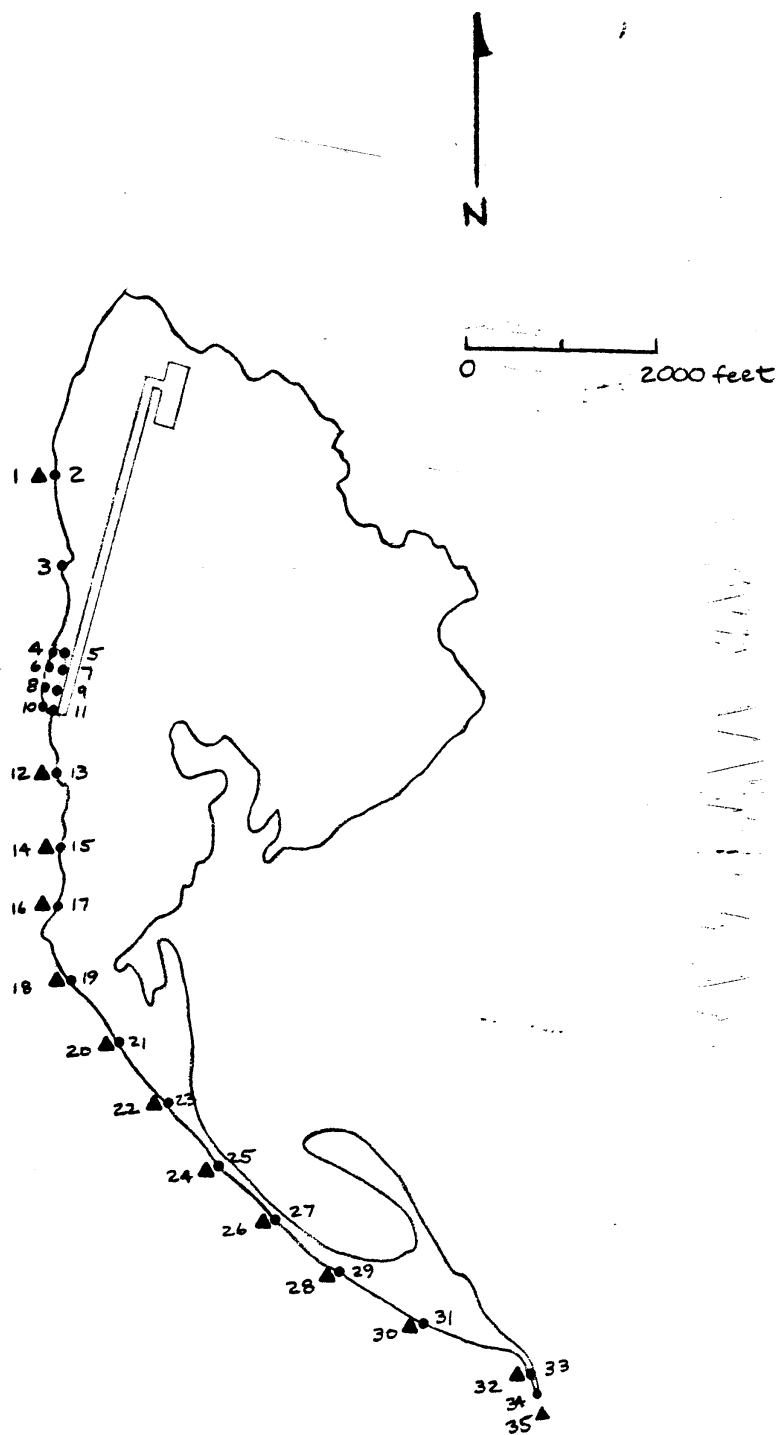


Figure 1 SEDIMENT SAMPLING SITES ALONG THE WESTERN SHORE  
OF TANGIER.

JRH  
31 Jan 83

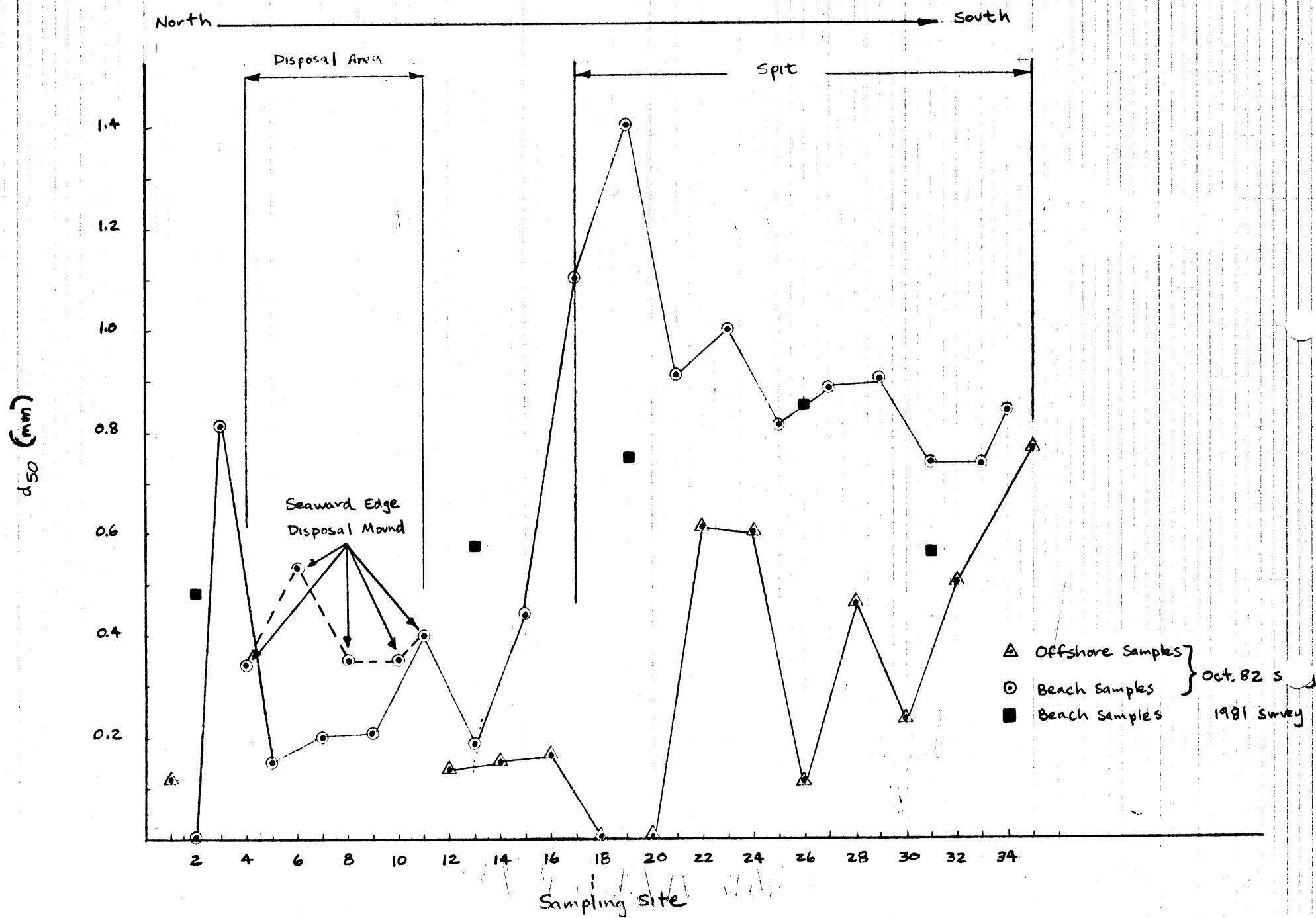


Figure 2. SEDIMENT CHARACTERISTICS ALONG THE WESTERN SHORE OF TANGIER ISLAND



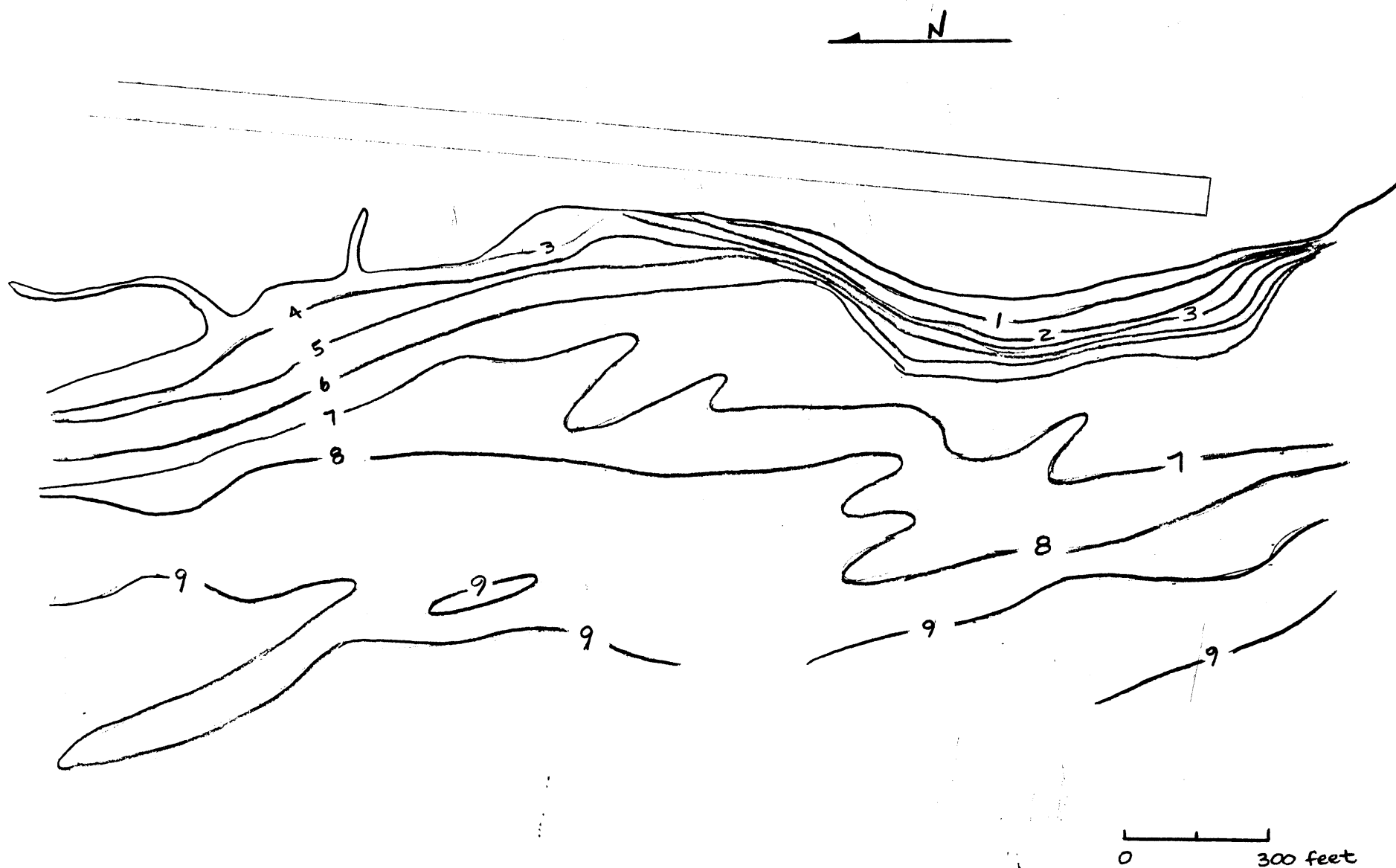


Figure 3 BATHYMETRY IN VICINITY OF DISPOSAL AREA

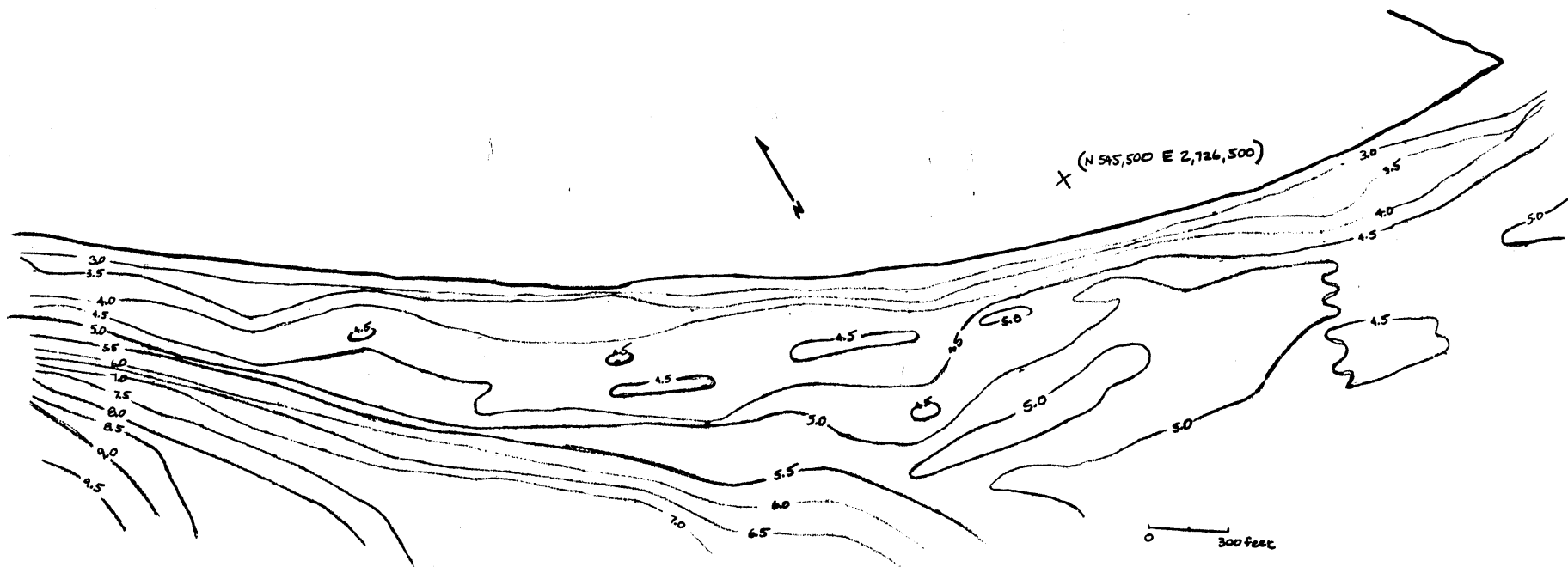


Figure 4 BATHYMETRY ALONG TANGIER SPIT

- ⊕ Existing Sediment Sampling Sites
- New Sampling Sites for Next Survey

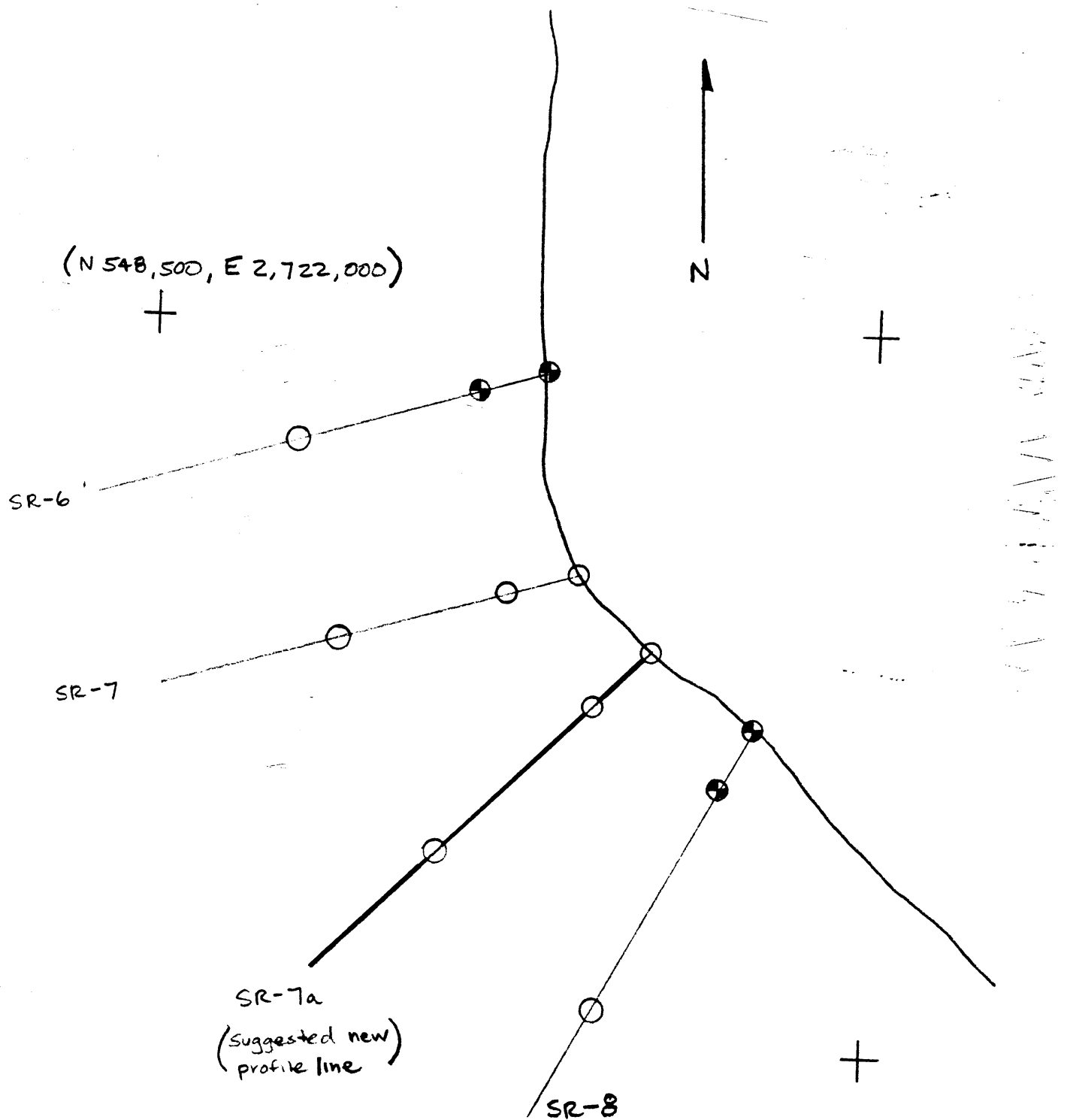


Figure 5 SUGGESTED LOCATION OF NEW PROFILE LINE AND SEDIMENT SAMPLING SITES

**TABLE 1**  
**SEDIMENT DATA\***

**Tangier Dredge Disposal Project from WS&E Survey**  
**October 1982**

Sample Identification		d <sub>50</sub> (mm)	Comments
Galvin	WS&E		
1	SS-12	.12	
2	SS-11	--	
3	SS-10	.81	
4	SS-8	.34	
5	SS-9	.15	
6	SS-5	.53	
7	SS-6	.20	
8	SS-3	.35	
9	SS-4	.21	
10	SS-1	.35	
11	SS-2	.40	
12	SS-14	.14	
13	SS-13	.18	
14	SS-16	.15	
15	SS-15	.44	
16	SS-18	.16	
17	SS-17	1.10	
18	SS-20	--	
19	SS-19	1.40	
20	SS-22	--	
21	SS-21	.91	
22	SS-24	.61	
23	SS-23	1.00	
24	SS-26	.60	
25	SS-25	.81	
26	SS-28	.11	
27	SS-27	.88	
28	SS-30	.46	
29	SS-29	.90	
30	SS-32	.23	
31	SS-31	.74	
32	SS-34	.73	
33	SS-33	.73	
34	SS-35	.84	
35	SS-36	.76	

\*Sites SS-7, SS-35, SS-36 not shown on Tangier Survey map.

JRH 31 Jan 83